hp StorageWorks
Booting 64-bit Windows Systems from a Storage Area Network

This document describes how to boot 64-bit Microsoft Windows systems from HP StorageWorks arrays.

For the latest version of these Application Notes and other storage documentation, access the HP storage storage web site at: http://www.hp.com/country/us/eng/prodserv/storage.html.

invent

Application Notes Contents

These Application Notes describe boot setup procedures for specific software solutions, Fibre Channel host bus adapter (HBA) firmware versions and EFI driver versions.

Intended Audience

This document is intended for customers who are familiar with:

- Enterprise Virtual Arrays
- Modular Smart Arrays
- XP 1024/128 Disk Arrays
- Windows operating systems
- HBAs
- Switch zoning
- HP Integrity servers

Introduction

Traditionally, HP Integrity servers boot operating systems from internal SCSI and IDE storage devices. With the support of external booting with StorageWorks Fibre Channel host bus adapters (HBAs) and RAID Arrays, customers can optionally eliminate server-based internal boot devices. Booting from an external device provides decreased downtime through faster server replacement in the event of a server failure.

Why Boot to a SAN?

Booting to the SAN provides:

■ Redundant storage paths

■ Disaster recovery

■ Improved security

■ Minimized server maintenance

■ Reduced impact on production servers

■ Reduced backup window

Additional information

For detailed information about HBAs, switches, storage arrays, and storage software, access the following HP web sites:

Topic	HP web site
HBAs and switches	http://h18006.www1.hp.com/storage/saninfrastructure.html
Storage array systems	http://h18006.www1.hp.com/storage/arraysystems.html
Secure Path	http://h18006.www1.hp.com/products/sanworks/secure-path/index.html
Integrity servers	http://welcome.hp.com/country/us/en/prodserv/servers.html

Supported configurations

This document describes single server, cluster, and Secure Path-based configurations using:

■ Enterprise Virtual Arrays (EVA) —multiple bus failover mode or single path

■ Modular Smart Arrays (MSA)

■ Disk Array XP 1024/128

Restrictions

Operating system restrictions

Microsoft Windows operating systems require a unique, dedicated disk for booting. Therefore, each server connected to a RAID Array must have its own disk, or LUN (Logical Unit Number), dedicated solely for booting and operating system files. Data can be allocated across both the boot disk and the remaining disks. Booting from array-based disk partitions is possible.

Note: The memory paging system requires fast access to the *pagefile.sys* file. In some cases, in SAN environments with heavy I/O loads, the access request for moving information to or from the paging file might be delayed. This can cause the operating system to halt, requiring a reboot to recover. Microsoft recommends that if paging errors occur, page files should be relocated to disks that are built into the server using its internal data paths. Microsoft has published a technical article with additional recommendations related to booting from a SAN at: http://support.microsoft.com/default.aspx?scid=kb;EN-US;q305547.

Clustered server restrictions

Microsoft requires that clustered servers (MSCS) keep boot disks on data paths that are separate from shared-storage paths. This requires a dedicated HBA port for booting and another HBA port for shared disks.

Standalone server restrictions

In a standalone server environment, an HBA port can share boot and data paths.

Server replacement in the event of a server failure

You must retain the HBAs to ensure that the replacement server hardware components are identical in every way to the ones you are replacing. Place each HBA into the PCI slots of the new server in the same order as they were placed in the old server.

If you are using an internal disk for your paging file system, you can move this disk to the replacement server. You can also use a new disk, but you must format it and manually reset the paging to that disk.

Required hardware and software

RAID Arrays

- Enterprise Virtual Arrays (EVA5000 and EVA3000) VCS v2.x and v3.x
- Disk Array XP1024/128
- Modular Smart Arrays

Note: Refer to the array documentation for detailed information.

Host bus adapters

- AB232A
- AB467A
- AB466A
- A7298A

Note: Refer to each adapter's release notes for LUN limitations.

Fibre Channel switches

Booting from the SAN is supported on B-Series, C-Series, and M-Series switch products. Refer to the *HP StorageWorks SAN Design Reference Guide* for the current list of supported switch models for these product lines. This guide is available at
http://h18006.www1.hp.com/products/storageworks/san/documentation.html

Servers

All HP Integrity servers are supported. For detailed information, refer to

http://welcome.hp.com/country/us/en/prodserv/servers.html

Operating systems

The following Microsoft Windows systems are supported:

- Windows Server 2003 64-bit Datacenter Edition
- Windows Server 2003 64-bit Enterprise Edition

Prerequisites

RAID arrays

To perform these procedures, you should be familiar with:

■ Modular Smart Array-based, Enterprise Virtual Array-based, or XP1024/128-based Fibre Channel RAID Array technology (depending on your system configuration) and the interconnections required to attach to an HBA in a Windows-based server. This information is in the RAID Array and/or Software Solution kit documentation.

■ Enterprise Virtual Arrays—Verify that all existing storage units (virtual disks) have the proper access settings.

■ XP1024/128—Verify that all existing storage units (virtual disks) have the proper access settings.

■ Switch-based configurations and zoning—If zoning is enabled, check the switch to ensure there are no zoning conflicts.

■ Windows Server 2003 Enterprise or Datacenter 64-bit Editions

HBA firmware, EFI driver, and drivers

You must have the following minimum versions:

■ Firmware:
   — AB232A—1.81a2
   — AB467A—1.81a3
   — AB466A—1.81a3
   — A7298A—1.81a2

■ EFI-Based Setup Utility (ESBU)—3.00a9

■ EFI firmware–5.00a5

■ HP Smart Setup Media v3.10 or later

Special considerations for boot disk partitions

■ Before attempting to create a boot disk, you must ensure that you are starting with a clean, unpartitioned virtual disk.

■ Create a LUN that is at least 32Gb

■ If you are planning to set up booting from a RAID Array that has other virtual disks attached to other servers, be aware that when setting up booting for the new server, the installation program displays a list of partitions available for loading the operating system. The display contains a disk for every controller port accessible by the HBA. Although it seems that there is more than one virtual disk available for booting, there is really only one available virtual disk.

Switch-based zoning

You must be familiar with switch-based zoning. For specific information about zoning for your environment, refer to your switch's installation guide.

Setting up switch zoning

You must set up switch zoning as part of your configuration. Refer to the figures in Cabling scheme options for single channel HBAs, page 8 and Cabling scheme options for dual channel HBAs, page 11.

Initial zoning setup

1. Create a zone that includes the boot HBA port and the one controller port using the WWN or switch port number.

2. Enable the zone.

Finalize zoning

1. Modify the initial zone to include the second controller port.

2. Create a zone in the second fabric to include the secondary boot HBA port and the two remaining controller ports.

Cabling scheme options for single channel HBAs

The following figures depict a two port controller. However, all HP arrays are not the same; therefore storage port configurations will vary.

Note: The zoning shown in each of the following figures are suggested zoning strategies. Two zones are the minimum requirement.

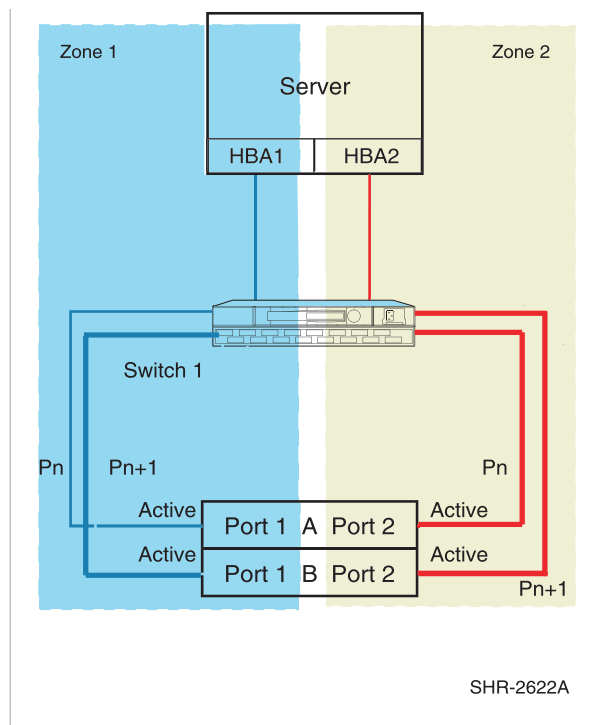SAN boot is supported in the zoned single channel HBA configurations as shown in Figure 1 through Figure 6.

Figure 1: Single server-two single channel HBAs, one switch straight-cable storage configuration

Booting 64-bit Windows Systems from a Storage Area Network Application Notes
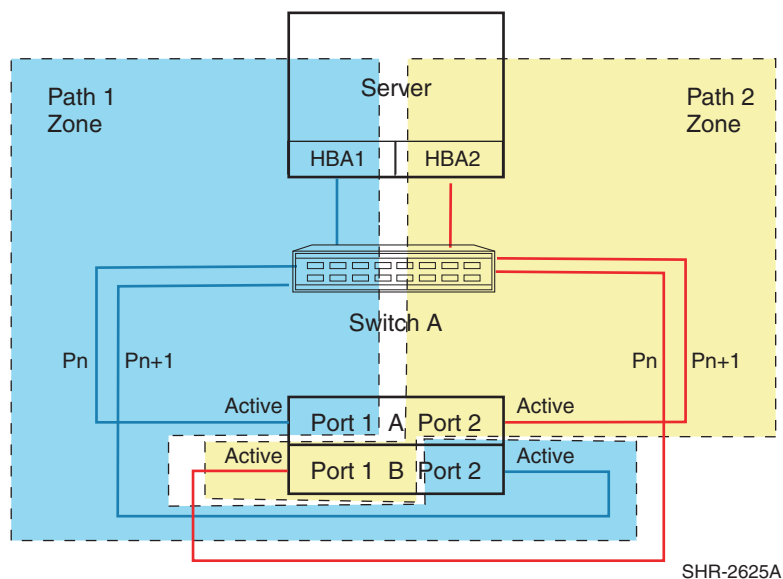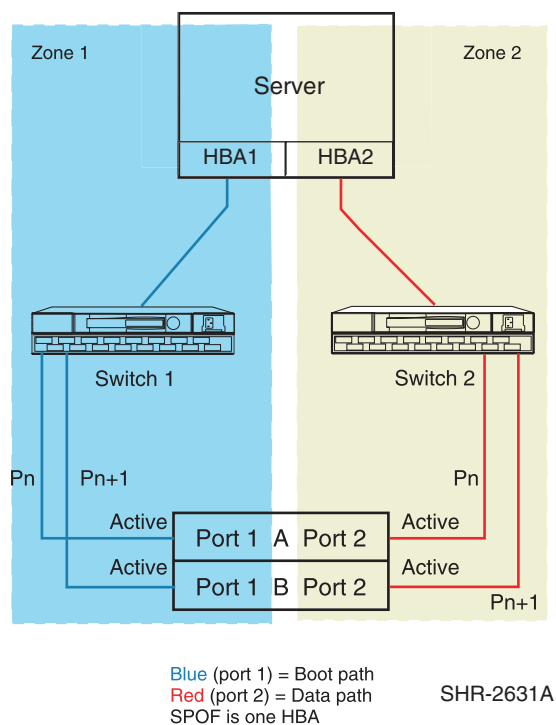
Figure 2: Single server-two single channel HBAs, one switch cross-cable storage configuration

Figure 3: Single server-two single channel HBAs, two switch straight-cable HA storage configuration

SHR-2427D
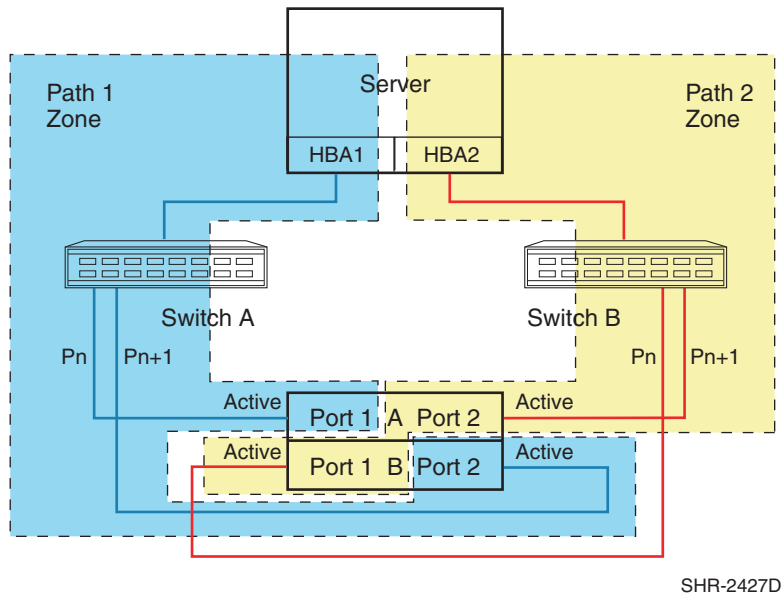
Figure 4: Single server-two single channel HBAs, two switch cross-cable HA storage configuration

Blue (port 1) = Boot path
Red (port 2) = Data path   SHR-2628A
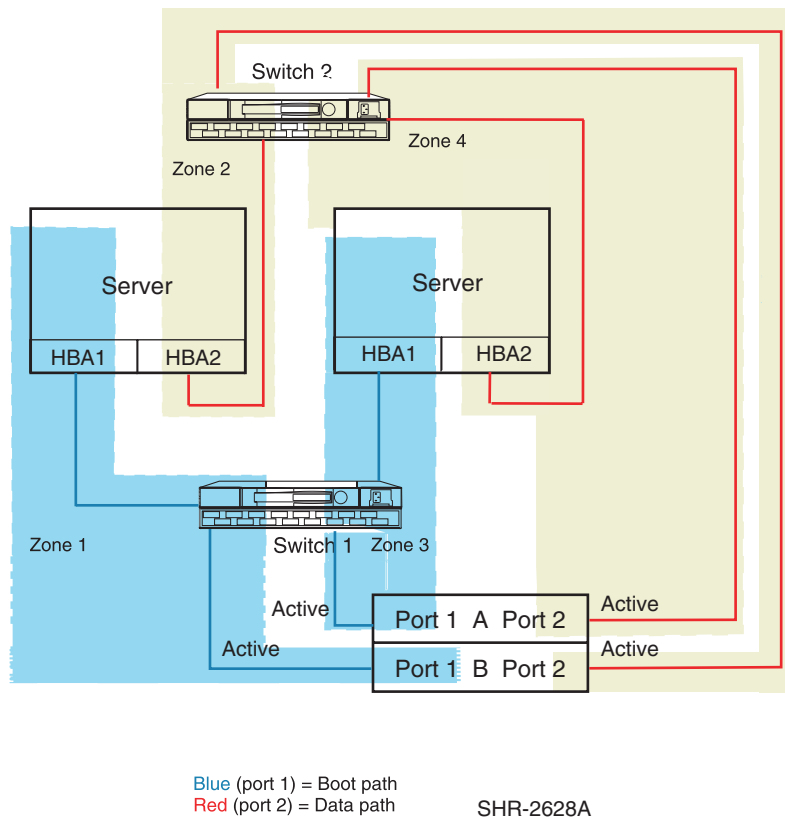
Figure 5: Clustered servers-four single channel HBAs, two switch straight-cable HA storage configuration

Switch 2

Zone 4

Zone 2

Server

HBA1 HBA2

Server

HBA1 HBA2

Switch 1

Zone 1   Zone 3

Active

Active

Port 1 A Port 2

Zone 2   Port 1 B Port 2   Zone 1

Active   Active

Blue (port 1) = Boot path
Red (port 2) = Data path   SHR-2630A

Figure 6: Clustered servers-four single channel HBAs, two switch cross-cable HA storage configuration

Cabling scheme options for dual channel HBAs

Dual channel HBAs are typically used in situations where the number of server PCI slots is limited. Figure 7 through Figure 12 show the cabling options for dual channel HBAs.

Figure 7: Single server-one dual channel HBA, one switch straight-cable storage configuration

.

Figure 8: Single server-one dual channel HBA, one switch cross-cable storage configuration
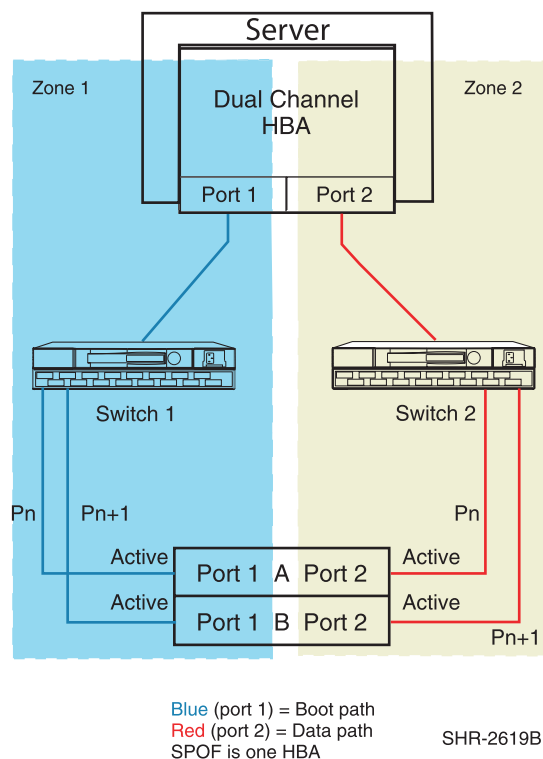
Figure 9: Single server-one dual channel HBA, two switch straight-cable HA storage configuration


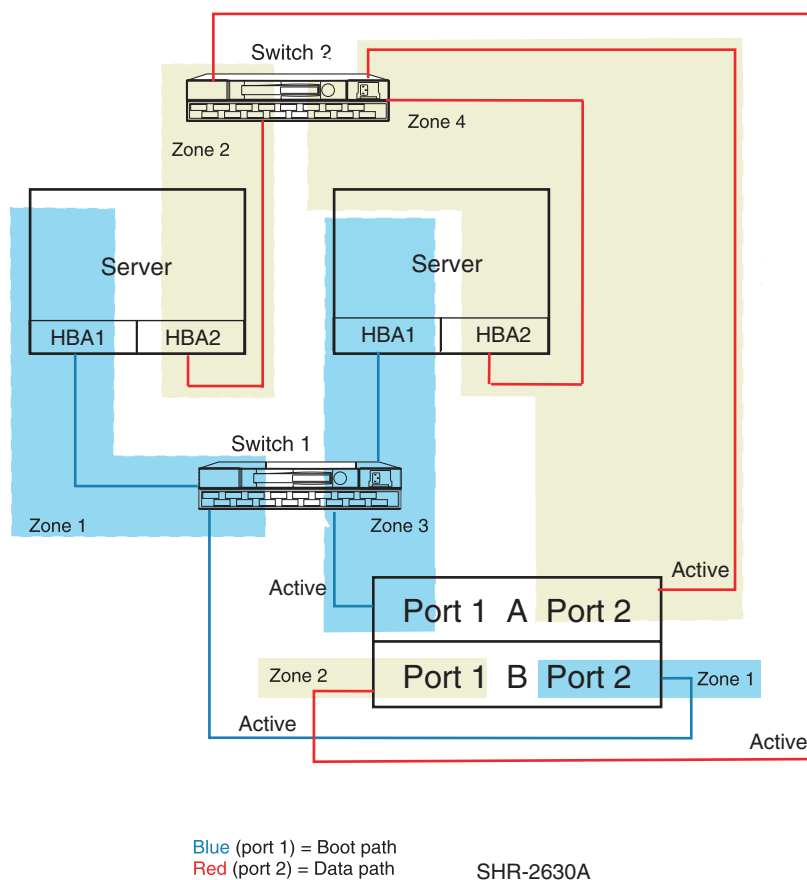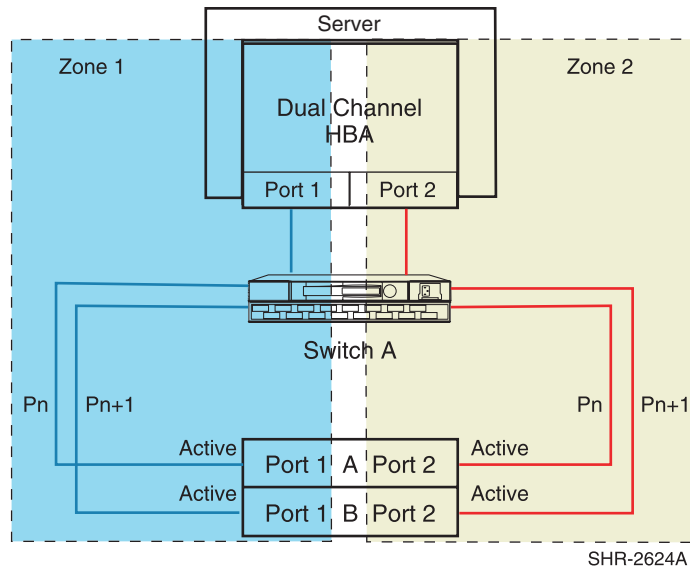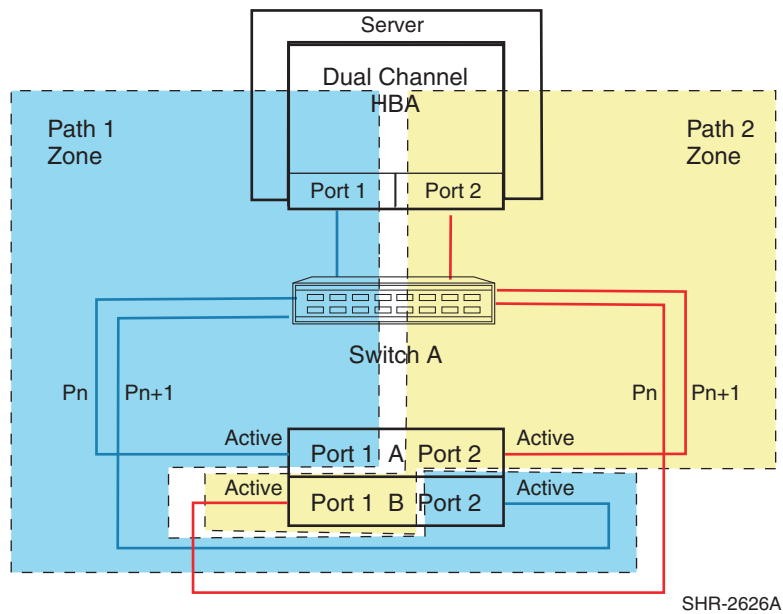**Figure 10: Single server-one dual channel HBA, two switch cross-cable HA storage configuration**

Blue (port 1) = Boot path
Red (port 2) = Data path
SHR-2627B

Figure 11: Clustered servers-two dual channel HBAs, two switch straight-cable HA configuration

Blue (port 1) = Boot path
Red (port 2) = Data path   SHR-2629A

Figure 12: Clustered servers-two dual channel HBAs, two switch cross-cable HA configuration

Considerations for booting clusters

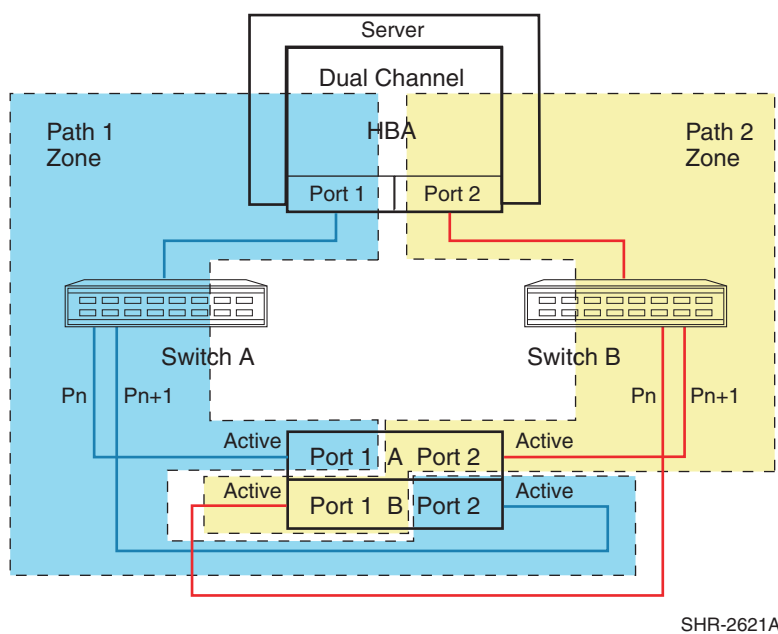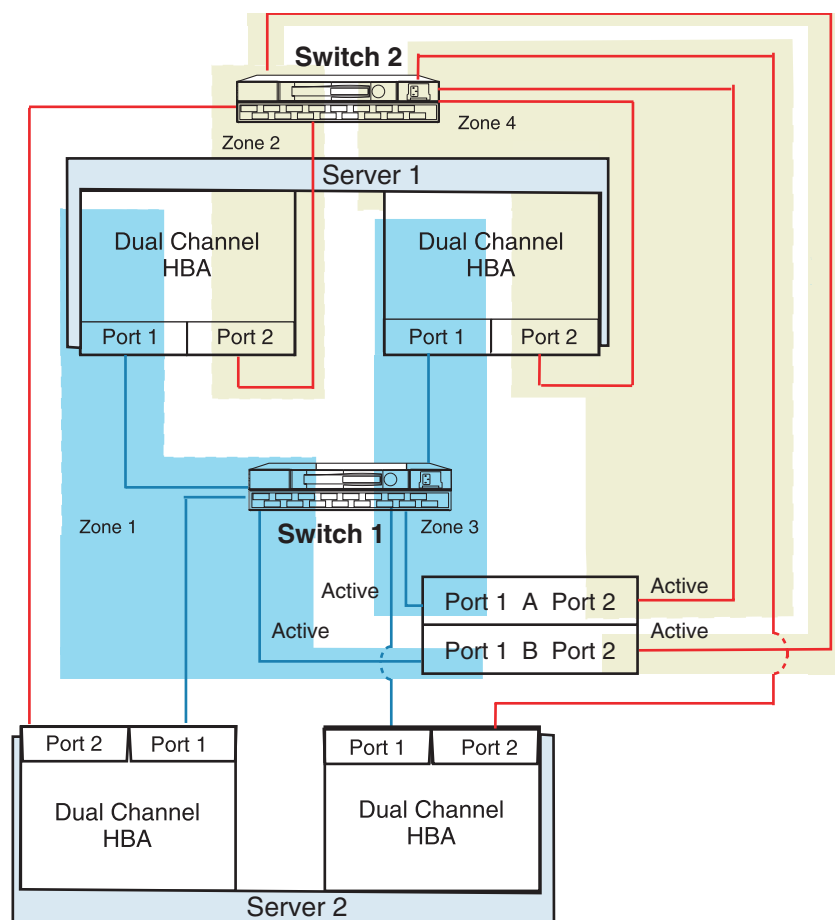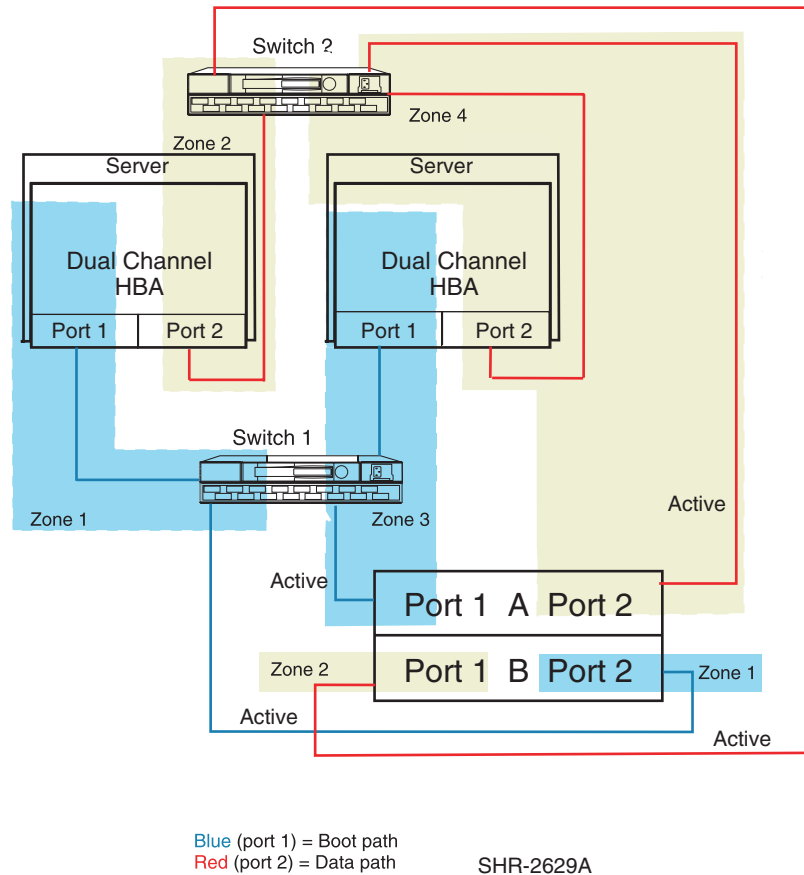Windows operating systems require that an HBA used for booting is not the same HBA used for cluster shared storage. Because of this, you must use separate HBAs or HBA ports in each server when setting up for cluster booting. In general, the key steps for setting up booting include:

- Installing all HBAs but not connecting them

- Configuring each HBA that attaches to boot disks for booting (for cluster, a RAID Array needs two, separate boot disks)

- Connecting and setting up each HBA for booting, one at a time

- Setting up disk connectivity from each intended, unique boot disk to its server, using the CLI or GUI

- Installing the Windows operating system on a unique and dedicated disk in the RAID Array, one at a time

- Making sure the drive letters are the same for both servers' boot disks

- Booting the servers

- Installing cluster software

Considerations for Secure Path

Secure Path provides high availability computing through a redundant data path to the RAID Array. Especially in a cluster situation, because of Microsoft's requirement that the boot HBA is different from the shared data HBA, each server needs four HBAs (with a minimum of two for boot and two for data, bringing the total number to eight HBAs. This provides data path redundancy for boot and data. Secure Path is an application that loads after the operating system has booted and should be treated the same as any other application installation.

It is strongly suggested to use more than one HBA port for boot and more than one for data. See the Secure Path web site for specific version information at http://h18006.www1.hp.com/products/sanworks/secure-path/index.html.

Set up the server

Before setting up for booting from a SAN, you must set up your server as follows:

■ Download and install the latest Integrity system firmware.

■ Remove the internal hard disks.

■ Record the WWN of each HBA port (each HBA should be tagged).

■ Install all HBAs and connect one port that is targeted for booting.

Update the HBA firmware and EFI driver

Use the following procedure for updating the firmware and EFI driver.

1. Insert the Smart Setup Media in the CD-ROM drive while the system is booting up. The EFI Boot Manager displays.

2. Choose **Bootable DVD to open the** EFI-Based Setup Utility (EBSU) as shown in Figure 13.
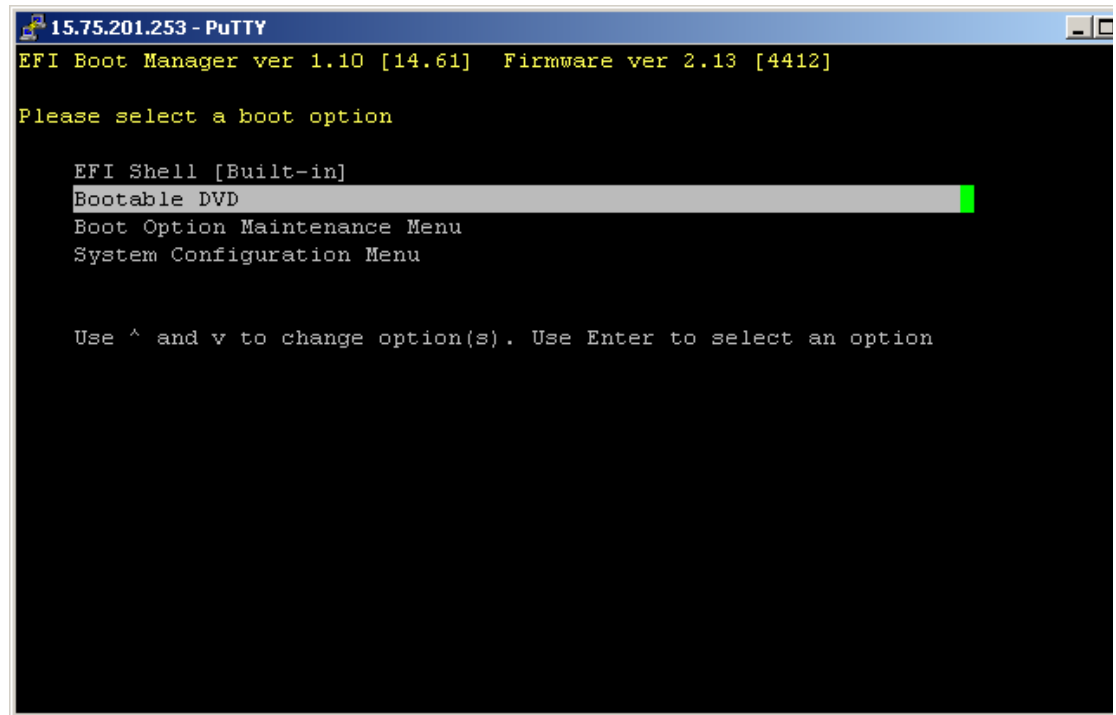
Figure 13: EFI Boot Manager

3. Click **OK** to access the Main Menu.

4. Press **F**, or scroll down and choose **Maintain Firmware**, as shown in Figure 14.
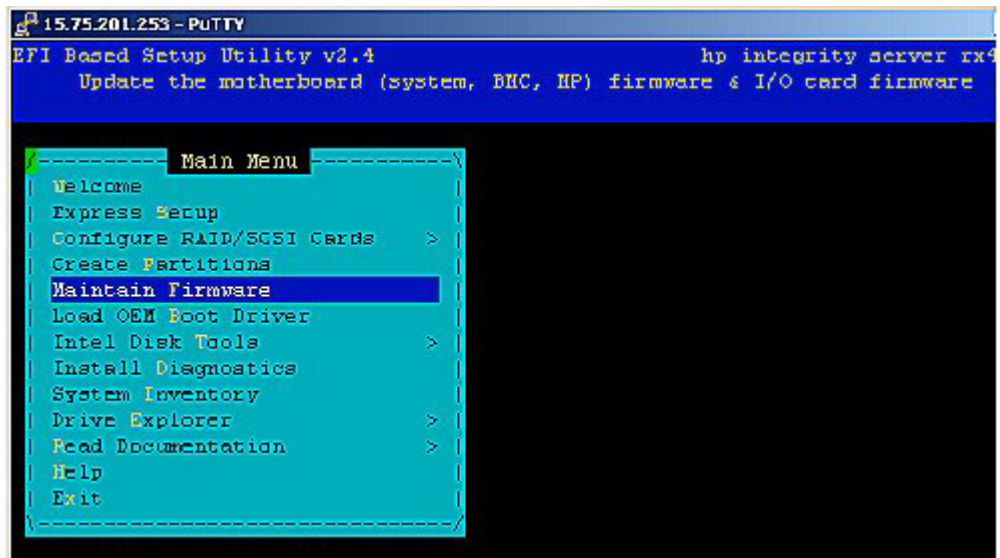
Figure 14: EFI Manager Main Screen

5. Verify that the HBA contains the latest firmware and EFI driver.

6. Select the devices that you want to update as shown in Figure 15.
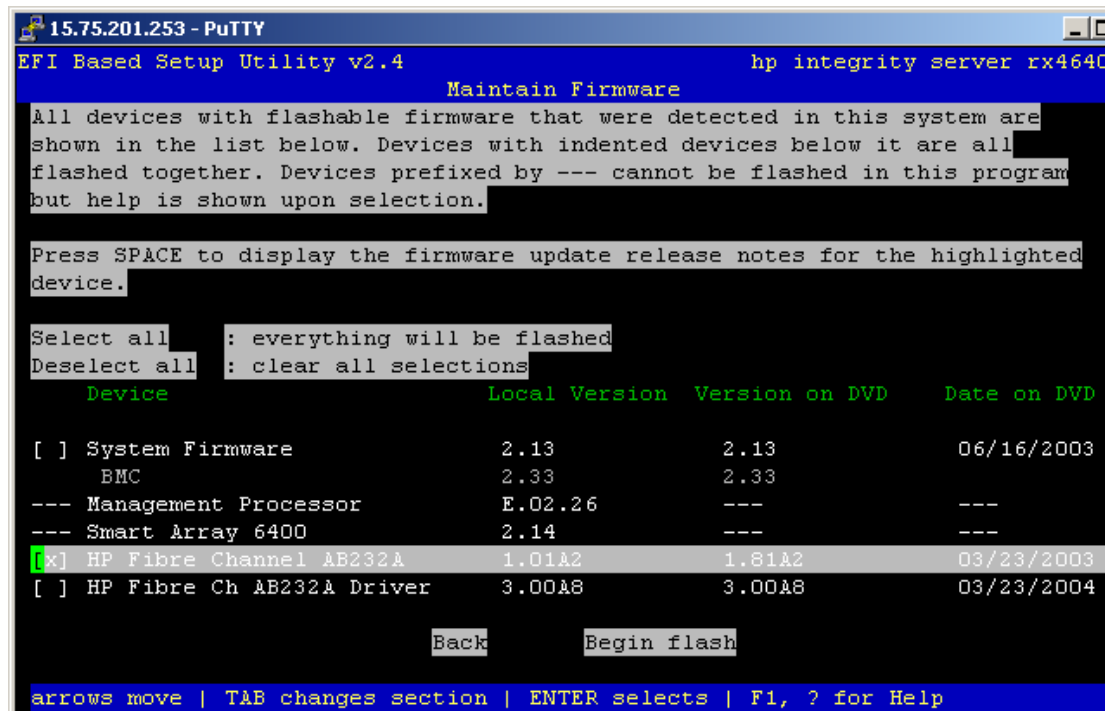
Figure 15: Selecting a component to flash

7. Press **Tab** to **Begin Flash** entry to flash the HBA.

8. At the prompt, press **Tab** to the **Continue** entry, then press **Enter** to begin the flash. After the flash completes, the utility automatically reboots the server and starts the EBSU. The EBSU displays that the flash was successful as shown in Figure 16.
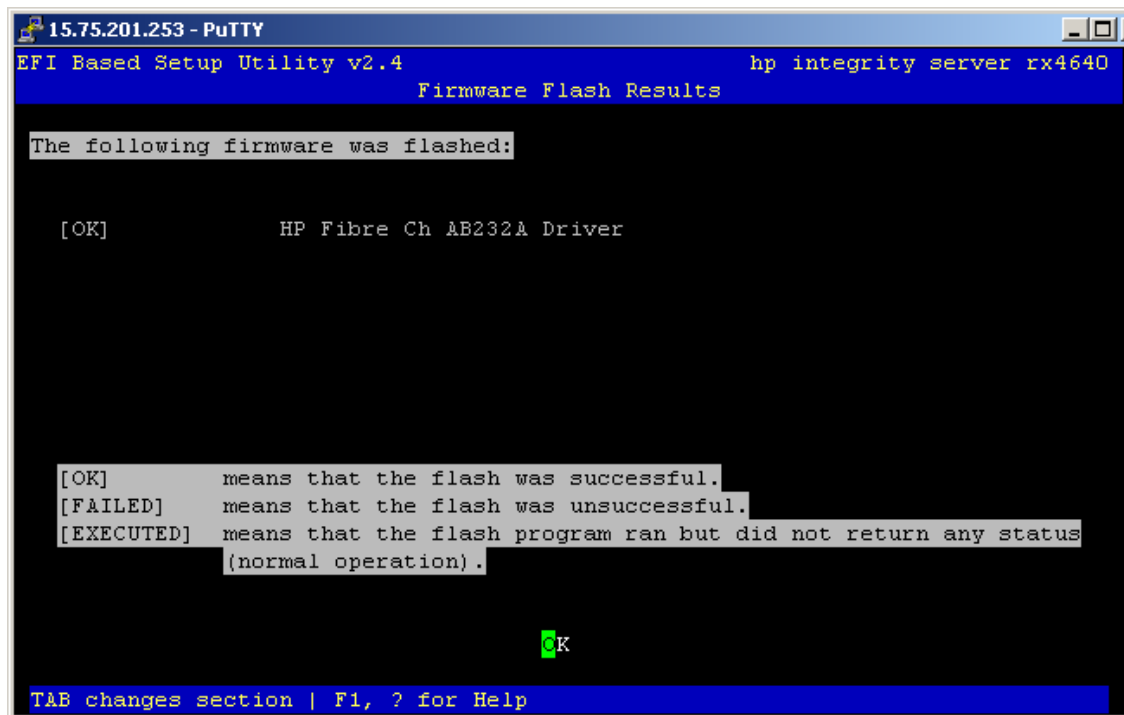
Figure 16: Firmware flash results

9. Press **Enter** at the Firmware Flash Result screen. Press **Enter** at the EBSU Welcome screen to return to the Main Menu.

Configure the boot device

Use the following procedure to configure the boot device.

1. Choose **Configure RAID/SCSI Cards** and navigate to the appropriate HBA as shown in the Figure 17.
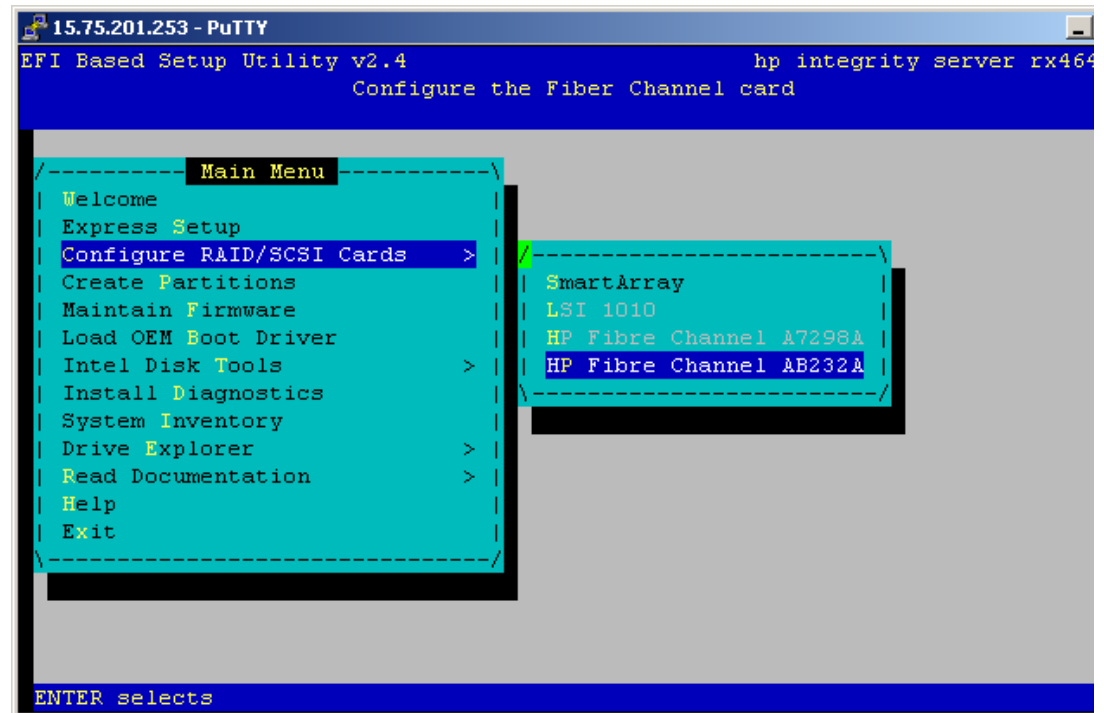
Figure 17: Configure the Fibre Channel Card screen

2. Select **Choose the adapter that you wish to configure** as shown in Figure 18.

Figure 18: Choosing the adapter screen

3. Choose **Setup Utility**.

4. Choose **Reset to Default Values**.

5. Enter **Yes** at the **Do you want to force defaults?** prompt.

6. Choose **Configure HBA Parameters**.

7. Choose **Enable or Disable BIOS**.

8. Choose **Enabled**.

9. Press **ESC** twice to return to main menu.

10. Choose **Configure Boot Device**. The Boot Table should be empty.

11. Press **Enter** to select the first line to boot.

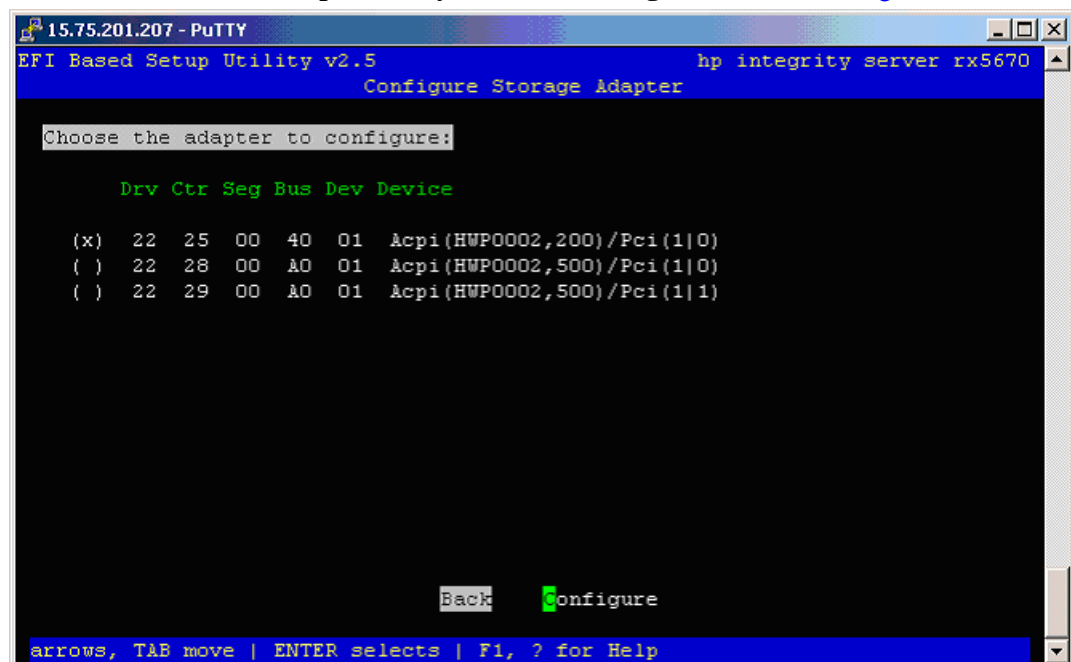**Note:** If there is an entry in the table, press **Enter** then choose **Clear Flash Boot Info.** This creates an empty table. Continue with the procedure.

---

12. Choose **Scan Targets** to return to the empty boot table screen. The HBA is now logged into the switch.

13. Follow the steps in "Initial zoning setup" on page 8, unless directly connected.

14. On the boot server, choose the first line to boot from and press **Enter**.

15. Choose **Scan Targets**. A single WWN displays. This is the node to which your boot device is attached.

16. Using the storage configuration application of choice, create a single LUN and give it access to the HBA WWN.

17. On the boot server, press **Enter** to display a single LUN. This is the LUN to which your boot device has access. Press **Enter**.

18. Choose **Boot this device via WWN**. The boot table has one entry that displays the boot device Target WWN and LUN information.

19. Press **ESC** until you exit the utility.

Install the operating system

You can install the operating system by using:

- Re-install CD-ROM
- Microsoft CD-ROM

Installing from the Re-install CD-ROM

To install the operating system using the Re-install CD-ROM:

1. Insert the Windows operating system Re-install CD-ROM.

2. Choose **Bootable DVD** from the EFI Boot Manager menu, as shown in Figure 19:


```
EFI Boot Manager ver 1.10 [14.61]  Firmware ver 2.21 [4334]

Please select a boot option

    Bootable DVD
    EFI Shell [Built-in]
    Boot Option Maintenance Menu
    System Configuration Menu


    Use ^ and v to change option(s). Use Enter to select an option
```
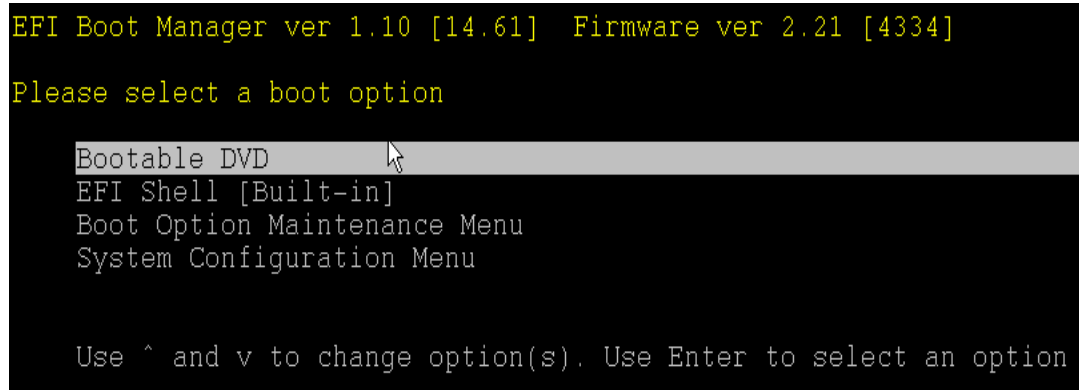
Figure 19: Installing the operating system with the Windows Re-Install CD-ROM

3. When the HP recovery console menu opens, click **Re-install**. Ignore the warning about deleting all data on the drive and click **OK**.

4. When asked to select the boot drive partition size, enter **C** to use the full drive size.

5. Use the latest Smart Setup CD-ROM to update the system drivers and agents.

Note: It is not necessary to reinstall the HBA driver unless an update is available.

---

6. Install Secure Path if applicable.

7. Install the operating system's latest service pack.

8. Reboot the server to complete installation.

9. Follow step 6 through step 18 on page 22 for each additional controller port assignment to the HBAs.

10. Connect any non-booting HBAs.

11. Follow the procedure in "Finalize zoning" on page 8.

12. Create and assign all other storage LUNs to the appropriate HBAs.

Note: For single path configurations skip step 6, step 9, and step 10.

Installing from the Microsoft CD-ROM

Load the FC HBA driver

1. Insert the HP Smart Setup DVD.

2. Choose **Bootable DVD** from the EFI Boot Manager (EBSU) menu and press **Enter**.

3. Choose **Load OEM Boot driver** or press **B** to display the Load OEM Boot driver screen as shown in Figure 20.
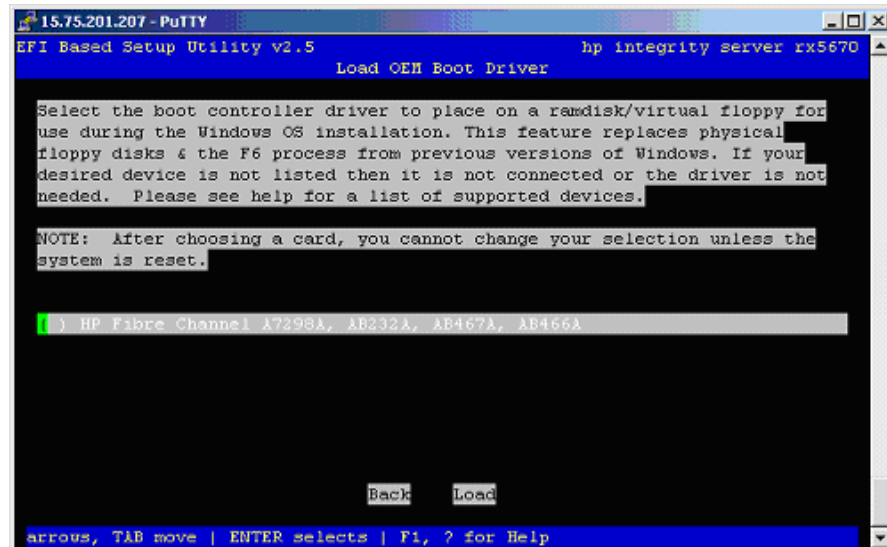

Figure 20: Load OEM boot driver

4. Choose **HP Fibre Channel A7296A, AB232A, AB466A** and press **Enter**.

5. Press **Tab** once to load the driver and press **Enter**. The system displays a confirmation message that the driver is loaded.

6. Select **Exit** or press **X** to exit.

Prepare the SAN disk device for OS installation

1. Choose **EFI Shell** at the EFI Boot Manager (EBSU) menu (as shown in Figure 13).

2. With the HP Smart Setup in the DVD drive, change to the CD-ROM file system.

Note: The CD-ROM file system might be mounted somewhere other than fs0

---

3. At the command prompt, change to the location of the Diskpart Utility.

   ```
   Shell> fs1:
   fs1:\> cd efi\efi_utils
   ```

4. Run the DiskPart Utility with the following command:

   ```
   fs1:\efi\efi_utils> diskpart.efi
   ```

5. List the partitions available:

   ```
   DiskPart> list
   ```

A display similar to the following example displays:

```
###   BlkSize    BlkCount
---   -------    ----------------
0       200     B40
1       200     4800000
```

Note: Device 0 is the Virtual Floppy Disk and Device 1 is the LUN created to install the operating system. The **BlkCount** varies depending on the size of the LUN created and does not match the LUN size.

---

6. Enter the `select` command to choose the boot device:

    ```
    DiskPart> Select 1
    Selected Disk = 1
    ```

7. Inspect the disk. If something other than the following message displays, use the `clean` command to destroy all partitions on the disk and make it RAW.

    ```
    DiskPart>inspect
    Selected Disk = 1
    The disk is RAW, nothing to inspect.
    ```

8. Create a GPT partition.

    ```
    DiskPart> new gpt
    ```

9. Exit DiskPart.

    ```
    DiskPart> exit
    ```

10. Remove the HP Smart Setup CD-ROM and place the Windows Server 2003 CD-ROM in the drive.

11. Rescan the drives. This allows the CD-ROM files system to access the Windows CD-ROM files.

    ```
    fs1:\efi\efi_utils > map -r
    ```

12. Enter **exit** to return to the EFI Boot Manager menu**.**

    You are now ready to install the Operating System.

Install the operating system

1. With the Microsoft Windows Server 2003 CD-ROM in the DVD drive, select Bootable DVD. Press any key to boot the CD-ROM to start the installation process.

Note: Do not press **F6** to load any Mass Storage Device drivers.

---

2. Use the latest HP Smart Setup CD-ROM to update the system drivers and agents.

3. Reinstall the HBA driver by locating and running the Smart Component by clicking **Drivers > Driver for 2Gb single channel FC HBA**. This sets the HP-supported registry parameters.

    You must reboot to implement these changes. However, you can wait to do so at step 6.

4. Install Secure Path.

---

5. Install the operating system's latest service pack.

6. Reboot the server to complete installation.

7. Follow step 6 through step 18 on page 22 for each additional controller port assignment to the HBAs.

8. Connect any non-booting HBAs.

9. Follow the procedure in "Finalize zoning" on page 8.

10. Create and assign all other storage LUNs to the appropriate HBAs.

Note: For single path configurations skip step 7 through step 9.

Set up the other server nodes

Repeat all of the setup steps described in the previous sections for the other servers before you begin the cluster installation.

Special considerations for Disk Array XP1024/128

Keep the following considerations in mind with XP1024/128 systems:

■ If one server is booting from a SAN, one host group is required for that HBA.

■ If more than one server is booting from a SAN and accessing the same physical port, a unique host group is required for each HBA. Every host group must be assigned on a port with a unique LUN 0. If LUN security is turned off for this port (for example, port CL1-A) all the servers defined in the host groups are suddenly given access to all LUNs contained in the default host group.

For detailed information about Disk Array XP1024/128 host groups, LUN Security, and host modes, refer to the *HP StorageWorks Command View XP User Guide* available at

http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&locale=en_US&docIndexId=179911&taskId=101&prodTypeId=12169&prodSeriesId=64820

■ To set up the remaining HBA ports, assign nonbooting HBAs to a different host group.